

- Fig. 15. *Parmula Batesii*. Skeleton-spicule, to show the "abruptly-pointed" form.
- Fig. 16. *Tubella reticulata*. Skeleton-spicule, to show "rounded end."
- Fig. 17. *Uruguayia corallioides*. Skeleton-spicule, to show micropunctuation and "rounded" ends.
- Fig. 18. *Spongilla nitens*. Skeleton-spicule, to compare with foregoing form.
- Characteristic skeleton-spicules of freshwater sponges from Lake Baikal, after Dr. W. Dybowski; traced off the figures in Taf. iv. (No. 32), drawn with Hartnack's prism and no. 4 objective.
- Fig. 19. *Lubomirskia baicalensis*, Pallas: a, "parenchyma-spicule," after Dybowski.
- Fig. 20. *L. bacillifera*, n. sp.
- Fig. 21. *L. intermedia*, n. sp.
- Fig. 22. *L. papyracea*, n. sp., two forms.

X.—*Spolia Atlantica: Contributions to the Knowledge of the Changes of Form in Fishes during their Growth and Development, especially in the Pelagic Fishes of the Atlantic.* By Dr. C. F. LÜTKEN.

[Continued from p. 14.]

8. BRAMA, TARACTES, PTERYCOMBUS, PTERACLIS.

With regard to *Brama*, it is to be remarked, in the first place, that it has been ascertained that *B. Raji* is not an almost exclusively Mediterranean species, but a bathyphilous and very cosmopolitan species, which is spread from the Färöes to the Cape, and represented at Chili, New Zealand, and Japan by very nearly allied, if not identical forms (*B. japonica*, Hilg., appears to be a distinct species), but has not yet been found among the Antilles or on the eastern coast of America. Leaving out of consideration some young forms (*B. Orcini*, *B. Dussumieri*) which cannot pretend to the rank of distinct species, a series of species from the Antilles, Madeira, &c. have subsequently been described, some with smooth scales, others, as in *Pteraclis* and *Pterycombis*, with a large spine upon the anterior margin of the visible part of each scale, and a corresponding notch in the posterior margin of the immediately preceding scale. It is a singular thing that it has not hitherto been observed that *B. Raji*, when young but yet about half-grown (290 millims.), has the scales armed with the same spines, which do not disappear until the fish approaches its full development. We are therefore not justified in forming a separate genus (*Taractes*) for the species of *Brama* with spines, nor in determining the young individuals furnished with spines (*Taractes asper*, *Brama Orcini* and

Dussumieri) as the young of species which retain the spinous character of the scales all their lives; for they may just as well belong to species which, like *B. Raji*, become completely smooth as they advance in age. The small *Bramæ* with spines, from 11–47 millims. long, that I have examined, which in general agree with the young forms above mentioned and formerly described, present no peculiarity which prevents our referring them to *B. Raji*; and consequently we may very well provisionally range these nominal species among the synonyms of the type species in question. It is probable, however, that the young individuals belonging to the different species of *Brama* will closely resemble one another, and be extremely difficult to distinguish; in those which I have at my disposal, some of which (the largest) were found in the stomach of large voracious fishes, and others (the smaller ones) fished at the surface of the Atlantic, I have been able to recognize only the elements of a single continuous series, and not the representatives of several species. One of the oldest and one of the youngest individuals of this series referred to *B. Raji* are represented in pl. iv. (of the Danish memoir); and I refer the reader for their differences and for their comparison with the adult fish to figs. 1 and 2.

With the young *Bramæ* which we have just been discussing there was also a *Pterycombus*, perhaps a young *P. brama*, an arctic species inhabiting deep water, hitherto known only from specimens derived from the coasts of Finmark and Norway; this specific determination, if correct, will furnish a fresh proof of the conformity presented in general by the faunas of great depths in the tropical and arctic seas. In the stomach of the same albacore which contained these interesting young *Bramidæ* there was also a young fish belonging to the arctic genus *Himantolophus*, perhaps *H. Reinhardtii*. Fig. 4, pl. iv. (of the Danish memoir), placed near that of the adult *Brama*, will elucidate the very considerable changes that the young *Pterycombi* undergo during their growth and development.

A pelagic genus allied to *Brama* and *Pterycombus* is the genus *Pteraclis*, the still little-known species of which perhaps need to undergo some reduction. Our sailors have also found it in the stomachs of albacores; and they have moreover captured in the nets very small examples of 7–15 millims. long. Their physiognomy greatly resembles that of the young *Bramæ* and *Pterycombi*; and they differ as much as these and the young dorados from fully developed fish. The body is short, thick, and pyriform; the scales are high and hexagonal, each armed with a spine directed backward; the præoper-

culum is very spinous; the dorsal and anal are low and almost completely retractile within their scaly sheaths; as in the young *Coryphæna* and *Pterycombi*, the dorsal does not commence so far forward as at a later period, and it is placed further back in proportion as the fish is younger; the ventrals are composed of a few very fine rays &c.

9. NAUCRATES, NAUCLERUS, and XYSTROPHORUS; NOMEUS, PORTHMEUS, LICHIA, and CHORINEMUS; PAROPSIS.

Mr. Gill and myself, some years ago, showed that the *Naucleri* are young forms of *Naucrates*; and the synonyms of the celebrated pilotfish (*N. ductor*) have consequently been augmented by the other probably merely nominal species of *Naucrates*, by all those of the genus *Nauclerus*, and by two species referred to the genus *Seriola*. But it has not hitherto been noticed that *Xystrophorus*, Rich., is nothing but the youngest form of *Naucrates*; moreover, among the first stages of *Seriola* there are also some which present, in part, the characters of *Xystrophorus*. The very young *Naucrates* are among the small fishes which are often met with among the arms, tentacles, &c. of the *Physalie*, pretty frequently associated with *Nomeus Gronovii*, which is not less pelagic than *Naucrates*. These little fishes, as well as the young of *Seriola*, *Coryphæna*, &c., are also met with in the floating masses of seaweeds. The young of *Naucrates* and *Nomeus* constitute the most frequent product of net-fishing in the open sea; and we thus possess numerous examples of them, which bear witness in favour of their wide geographical distribution. In *Nomeus* the changes arising from age and development are comparatively insignificant, but, perhaps, only because they occur so early that they have not hitherto attracted attention.

Porthmeus argenteus, of which our museum possesses an example 74 millims. long, from the coast of Guinea, is not, as has been supposed, a young form of *Chorinemus*, but of *Lichia amia*. As this species must be referred to a different genus from *Lichia glaucus*, we may very well leave to the latter the name of *Lichia*, and in future designate *L. amia* under that of *Porthmeus amia* (Lac.). On the other hand, *Lichia calcar*, Bl., of which I have before me a specimen 25 millims. long, is a young form of some *Chorinemus* of the Atlantic with four dorsal spines, perhaps *Chorinemus saliens*. The museum has received a corresponding series of a *Chorinemus* from the Indian Ocean 25-34 millims. long, with seven spinous dorsal rays, including successive stages up to the perfectly developed although still very young form. For the subdivision of this genus it would be best to employ a difference hitherto

unnoticed (see the fig. on p. 512 of the Danish memoir), namely the existence or absence of teeth on the pterygoids side by side with those of the palatines and vomer, in accordance with the following scheme, the divisions of which must, however, only be estimated as sections or subgenera, and not as true genera:—

- A. 4–5 (6) dorsal spines; scales linear; no teeth on the pterygoids. *C. occidentalis, saliens, palometa* (*Oligoplites*, Gill).
- B. 7 dorsal spines, and teeth on the pterygoids.
1. Scales linear: *C. tol* (*C. moadetta*, Klz., perhaps the young form of *C. tol*).
 2. Scales short and broad: *C. lyson, sancti Petri*, and a new species from Singapore which greatly resembles *C. altus* of the western coast of Central America.

In some species the teeth of the upper jaw are uniserial, and in others bi- or pluriserial; but those of the mandible are always biserial, although here a remarkable difference due to age makes its appearance; the older individuals are *homodont*, and the young *heterodont*. In other words, in the young *Chorinemi*, until they are about half-grown, the outer row in the mandible consists of very small, numerous, setiform teeth placed very close together (almost as in the *Chaetodonts*), which are very different from the strong, conical, recurved teeth, separated by distinct intervals, and consequently much less numerous, of the inner row. During the growth of the fish these outer teeth are replaced by a new row of teeth, which, according to the species, are identical with, or more or less similar to those of the inner row. A somewhat superficial observation of these important modifications of the dental system, which depend upon the age of the individual, might easily lead to the establishment of unfounded specific distinctions. The pterygoidian teeth, mentioned above, likewise exist in the genus *Paropsis*; and this genus presents another peculiarity not previously mentioned, namely the ramification of the lateral line, which, however, seems to become less marked with increasing age.

10. PSENES, CUBICEPS, and NAVARCHUS.

It is already known that *Navarchus* is generically identical with *Atimostoma* and *Trachelocirrus*, as also that this genus falls into that of *Cubiceps*. But in the present state of science it is equally difficult to separate the genera *Psenes* and *Cubiceps*. Under these two names a series of species have been described which are for the most part young forms still un-

known in the adult state, and which will no doubt have to undergo reduction. Among the rather numerous small pelagic individuals of the genus *Psenes* possessed by our museum, I have been able to distinguish five or six species; but I have only partially succeeded in referring them to those which have been described. I regard as new a high, short, and very compressed form, nearly colourless and semitransparent, from the Straits of Surabaya, *P. pellucidus*, sp. n. (figured p. 516 of the Danish memoir), which, I suppose, could not very well represent the juvenile form of a *Navarchus*. Another form very widely distributed in the Atlantic is represented in pl. v. fig. 2 (of the Danish memoir); I have made it provisionally a new species under the name of *P. maculatus*, but strongly suspect that it may be a young form of *Navarchus sulcatus* (*Cubiceps gracilis*), or of *Atimostoma capense* (species which are perhaps identical), or of some analogous form. We shall hardly deceive ourselves if we regard these three types (*P. maculatus*, *N. sulcatus*, and *A. capense*) as three successive stages of a single species, or, at any rate, of several very nearly allied species, which only appear rarely at the surface of the sea in their developed state, and which, in consequence, are still but little known to naturalists; perhaps, indeed, it is not precisely my *Psenes maculatus*, but another nearly allied form, which I have met with more rarely, and which is distinguished by a smaller number of rays in the vertical fins, that is really the young form of *Navarchus sulcatus* and *Atimostoma capense*. The group *Psenes-Cubiceps* is, in point of fact, one of the pelagic groups of which we know least, and with regard to which we have scarcely begun to lift a little corner of the veil which hides the rich ichthyological fauna of the great depths. In none of these young or more advanced forms of *Psenes* have I found a spinous præoperculum as in so many other young Scomberoids, and as is the case in the adult state with the præoperculum and interoperculum of a fish which appears to be very nearly related to *Psenes*, namely *Palinurichthys* (*Pammelas*) *perciformis*; there is nothing which seems to indicate that any of the forms of *Psenes* that have been described, or that I have examined, can be derived from that species, which is only known from specimens from the eastern coast of North America.

11. STROMATEUS, APOLECTUS; SCHEDOPHILUS; TRACHYNOTUS; MICROPTERYX; SERIOLA.

The conjecture has already been put forward that the "*Rhombus crenulatus*," Cuv., is a young form of *Stromateus alepidotus* (*Gardenii*, *longipinnis*). Dr. Günther has also

shown that *Stromateus securifer* is only a young *S. argenteus* (*candidus*); and the subordination on the same ground of *Apolectus stromateus* to *S. paru* is confirmed by the description of a little fish (13 millims.) from the Straits of Riouw, with large ventrals and the margin of the præoperculum denticulated, in which I have recognized a still younger form of the *Apolectus* and of *S. paru*. In consequence of these analogies, and depending in part upon the materials at my disposal, and in part on what I have found in the literature of the subject, it seems to me more than probable that *S. (Seserimus) microchirus*, with more or less rudimentary ventrals, is a young form of *S. fiatola*; but as this question, when once raised, may easily be elucidated by the ichthyologists of the Mediterranean coasts, I shall leave to them the task of solving it, and shall not discuss it further. With regard to the genus *Stromateus* I shall further remark that the separation effected by M. Bleeker of the three species *S. argenteus*, *cinerea*, and *sinensis* (*atous*, *albus*) as forming a distinct genus, *Stromateoides*, must be sustained. This genus is chiefly characterized by its short branchial clefts; young examples of *Stromateoides sinensis* also confirm the proposition, already advanced by M. Bleeker, that the ventrals, in this genus, disappear earlier than in the true *Stromatei*, if indeed they are not completely deficient. *S. medius*, Pet., is a true *Stromateus*, and not a *Stromateoides*.

The genus *Schedophilus*, which belongs to the true pelagic fishes, counts several (4) species; I shall abstain from discussing whether it may not be necessary to make them undergo some reduction. The pretty numerous specimens, chiefly young, that our Museum possesses must all be referred to *S. medusophagus*. The differences of age manifested in the proportions of the parts of the body, the system of coloration, &c. might certainly, if we examine them isolatedly, give rise to the establishment of illegitimate species; but they have no great importance from a general point of view.

The great differences arising from age, which, in the genus *Trachynotus*, have caused a series of false species, and even genera (*Doliodon*, *Bathrolæmus*) to be established, have already been dealt with by MM. Günther and Gill, and I have nothing essential to add. I shall only remark that *T. rhomboides* of the West Indies already has its rhomboidal physiognomy and its much prolonged sickle-shaped fins at an age when these prolongations of the fins are still rather short in the *T. ovatus* of the Indian seas, and that I am of opinion (with Mr. Gill) that these two species must be regarded, at least provisionally, as distinct. On the other hand, *Micropteryx* (*Chloro-*

scombus) *chrysurus* is not one of the forms in which the changes due to age can give rise to the establishment of deceptive species. Nevertheless the scapular and præopercular spines, which are characteristic of so many Scomberoids in the first phases of their development, are not wanting in the youngest individuals (10–25 millims.) of the series that I have examined.

The division indicated by G. Cuvier, and effected by Mr. Gill, of the genus *Seriola* into two distinct genera, *Zonichthys*, Swainson, and *Halatractus*, Gill, seems to be very natural. (*S. gigas* is the type of a third genus, *Naucratoropsis*, Gill; and *S. Dussumieri* and *succincta* are young forms of *Naucrator ductor*). To the genus *Zonichthys* belongs *S. nigrofasciata* (with which *S. intermedia* is no doubt to be united); the genus *Halatractus*, or *Seriola* proper, includes *S. Dumerilii*, Risso (with which I identify not only *S. purpurascens*, Schl., but also *S. Solandri*, C. & V.), *S. quinqueradiata*, Schl., *S. zonata*, Mitch. (*carolinensis*, Holbr.), and *S. rivoliana* (*S. Boscii*, *falcata*, and *bonariensis* perhaps do not differ from this last species). *S. tapeinometopon* (an example 73 millims. long from the Indian Ocean) is no doubt only a young form of *S. Dumerilii*, with the transverse bands which are characteristic of so large a number of young Scomberoids. Young *Seriolæ* are tolerably frequent in our pelagic collections; the entire group may therefore no doubt be regarded as subpelagic, and certain forms (such as *S. rivoliana*) as completely pelagic. Besides several more or less juvenile forms of *S. Dumerilii* and *S. rivoliana*, our museum possesses very young forms (19–26 millims.) with the head armed with very large spines, and greatly resembling the so-called *Xystrophorus* phase of *Naucrator*; I have referred them to *S. zonata* (*carolinensis*); lastly, young spinous forms of *S. nigrofasciata* and *S. quinqueradiata*, with regard to which I refer to the figures (pl. iv. figs. 7–11 of the Danish memoir) for the greater or less differences in physiognomy, the system of coloration &c. which distinguish them from the adults. I think also that we must refer to the subpelagic forms the *Seriolichthys bipinnulatus* (the præoperculum of which, notwithstanding what has been said, is not denticulated), as having been observed not only in the Indian Ocean, but also in the Mediterranean and the West Indies. The *Seriollellæ* having been identified with the *Nepotomeni* by Dr. Günther, we must suppose that the armature of spines indicated in them likewise does not constitute a permanent character.

12. CARANX, CARANGICHTHYS; GALLICHTHYS; SELENE
(ARGYREIOSUS, VOMER).

In the *Caranx* group too many and too few genera have been established. Following the principles adopted by certain authors, we might establish still more of them; for several undescribed species represented in our museum must furnish types for new divisions; on the other hand, we cannot approve of suppressing them all. A critical revision allows us to retain the six following genera:—

1. *Trachurus*, Cuv. (Gthr.). The lateral line is cuirassed throughout its whole length. The species of this genus have erroneously been united into a single one; I am able to distinguish the following:—*T. Linnæi*, Malm, the form from the Northern seas, which, however, is also met with in the Mediterranean; *T. mediterraneus* (Steind.), which also probably occurs in the Northern seas, where, however, it is certainly rare; *T. Cuvieri*, Lowe (Madeira, West Indies, west coast of South America); *T. japonicus*, Blkr. (China, Australia). The relative proportions between the two parts of the lateral line, its more or less sudden or oblique inflexion, and the height of the plates in proportion to their breadth, furnish good specific characters.

2. *Megalaspis*, Blkr. With 8–9 finlets separated from the dorsal and anal.

3. *Decapterus*, Blkr. A single finlet (the last ray of the fin) separated from the dorsal and anal.

4. *Caranx*, Cuv. Lateral line incompletely cuirassed as in 2 and 3; no isolated finlets. *Carangichthys* is only a young *Caranx* with the præoperculum denticulated. This genus has been divided into a great number of subgenera, which it would be superfluous to enumerate, and which ought all to be suppressed.

5. *Gallichthys*, Cuv. Naked, or nearly scaleless; the first dorsal is rudimentary in young individuals, and altogether wanting in the adults. *Blepharis*, *Scyris*, *Hynniss*, &c. are founded upon differences arising from age, and must consequently be eliminated.

6. *Selene*, Lac. (*Vomer*, *Argyreiosus*, &c.).

The young of *Caranx* and *Trachurus*, down to a length of 10–14 millims. for the smallest, are often brought by the sailors, and we thus possess a great number of them; but it is not possible to determine their species with exactitude except when they occur in more complete series, which enable us to recognize the characters of the adult. In my memoir I indicate the differences arising from age that I have observed in certain species,

especially from the West Indies ; and these, considering the difficulty of distinguishing from each other the species belonging to these genera, merit some attention. The youngest individuals with no scales or lateral line, and with a spinous præoperculum, certainly do not present any character which enables us to decide whether they are *Trachuri* or *Caranges*. The species in which I have observed the greatest changes during growth and development is *C. armatus* ; but they are already in great part well known, and I shall not here examine them in more detail. These changes are, however, very inferior to those observed in the *Gallichthyes*, which have been divided into more genera than there are species in reality, because the successive stages which recur in an analogous manner in the different species have been interpreted as constituting so many separate generic types—the result of which has naturally been that the diagnoses of the species have become as incorrect as possible, and that systematic confusion has attained its final limits. Each of the three or four existing species passes through a phase of *Blepharis* (*Gallichthys*), one of *Scyris*, and one of *Hynnus*. *Hynnus goreensis* is thus the adult form of *Gallichthys ægyptiacus* and of *Scyris alexandrinus* ; the forms described by Poey under the names of *Scyris analis* and *Hynnus cubensis* correspond in the same way to *G.* (*Blepharis*) *crinitus*. The *Scyris* phase belonging to *G. ciliaris* has not been before described. It may be asked (but, owing to the want of sufficient materials, I cannot decide the question) whether *G. ciliaris* of the Indian Ocean differs specifically from the American *G. crinitus*. If these two forms, comparatively rare in the adult state, are, as I suppose, fishes which inhabit tolerably deep water, we can understand that the same species might occur in seas far distant from each other. The general rule which finds its expression in the changes of form produced in this genus may be summed up as follows:—Greater and greater elongation of the body, so that its original proportions are completely altered ; reduction of the number of spinous rays in the dorsal and anal fins, as also of the filamentous prolongations of the ventrals, and, later on, likewise of those of the dorsal and anal.

Exactly similar changes occur in the genus *Selene*, Lac. (p. p.) (= *Argyreiosus*, *Vomer*, *Platysomus*) ; and in consequence “analogy” and “affinity” have been until very lately confounded in them as in *Gallichthys* ; nay, more, after Dr. Günther had elucidated the filiation of the forms in the essential points, the justice of his views was contested, and the error again maintained with a certain emphasis.

Leaving out of consideration *Argyreiosus dorsalis*, with regard to which I will not attempt to decide whether it is a variety of *Selene setipinnis* or a distinct species, it seems to me evident, from all that I know in nature and from literature, that instead of four species there are only two on the east coast of America, namely *Selene (Argyreiosus) vomer*, Linn., and *S. setipinnis*, Mitch. (*Vomer Brownii*). I have illustrated by two series of figures (pp. 543 and 547 of the Danish memoir) the development of these two species and the changes they undergo with age. The young form of *S. setipinnis* has been described under the name of *Argyreiosus unimaculatus*; if consistency had been desired it might have been set up as a distinct genus; the very old form of the same species is *Platysomus micropteryx* of Swainson. *Argyreiosus vomer*, L., *Zeus rostratus* and *Argyreiosus capillaris* of Mitchell, *A. Spixii*, Cast., *triacanthus* and *Mauricei*, Sw., and *senegalensis*, Guich., are all one and the same species, *Selene vomer* (L.), which, in its complete development, is represented by the *Selene argentea*, Lac., described by Brevoort. The two species attain nearly the same size (2 feet), and follow a very parallel course in their evolution—with this reservation, however, that the successive stages present greater differences among themselves in *S. vomer* than in *S. setipinnis*, and that the principal changes are earlier accomplished in this latter species. As will be seen from the figures, the young forms of the two species have the body very short and thickset; the first dorsal and the ventrals are well developed, and have filamentous prolongations in *S. vomer*; with age the body extends more or less in length, and the ventrals as well as the first dorsal are reduced to a minimum, while the pectorals become elongated, and the first ray of the anal and that of the second dorsal acquire an enormous length, in *S. vomer*. Thus, in proportion as the form of the body is modified, the prolongations of the fins which in the young perform the office of instruments of movement or of balancement, are replaced in the adults by prolongations of the same nature, but developed elsewhere. Both species occur on the west coast of Africa, and they have also been met with on the west coast of America. I must, however, remark that the species from Nicaragua possessed by our museum, and which there represents *S. vomer*, is a distinct species (*S. Oerstedii*, m.), distinguished by a peculiar profile and by the number of its rays (D. 8 . 1 . 18; A. 1 . 15).

13. ZEUS; ZENOPSIS (LAMPRIS; MENE).

A critical comparison of the materials in the possession of our museum, in the form of fishes from St. Pierre, in the

Mediterranean, combined with the statements contained in literature, has led to a fresh examination of a question which has also been raised elsewhere—namely, whether *Zeus faber* and *Z. pungio* must really be considered distinct species, or only varieties with a more or less local character. It is clear that the differences which have been appealed to are not characters relating to sex or age; but at the same time it results, from the examination that I have made, that *Z. pungio* can, at the utmost and even with difficulty, be regarded only as a variety of *Z. faber*, and by no means as a distinct species—an opinion which seems to be shared by the greater number of the Italian ichthyologists. The only somewhat constant character is the form and size of certain scutes at the base of the second dorsal. On the other hand, I must maintain that *Z. australis*, Rich. (Australia), is a perfectly different species from *Z. faber*, but perhaps identical with *Z. japonicus*; whether *Z. capensis* is a third species, or to be combined also with *Z. australis*, is a question still to be solved; in any case it will belong to a species distinct from *Z. faber*. It is no doubt with good reason that Mr. Gill has established the genus *Zenopsis* for the species more exclusively inhabiting the deep waters (which can hardly be said of the true species of *Zeus*), such as *Z. conchifer* (Madeira, with *Z. ocellatus* of North America) and *Z. nebulosus* (Japan); but the right of these species to be considered distinct still needs revision, which is the more necessary as the characters indicated are of rather doubtful value, and as we have here to do with species inhabiting the great depths of the oceans, and the geographical distribution is often very extensive in the fish of this category. I shall refer finally to the note by Dr. Günther on a supposed juvenile form of *Mene maculata*, a note which is, so to speak, the harbinger of the interesting particulars which the future will no doubt bring us as to the hitherto unknown metamorphoses of the genera *Zeus* and *Lampris*.

14. PSETTUS; ZANCLUS and GNATHOCENTRUM; PLATAX.

Dr. Günther has already demonstrated that *Gnathocentrum*, Guich. (*Zanclus canescens*, L.), is only a young form of *Zanclus cornutus*; nevertheless the late M. Bleeker, in his 'Atlas Ichthyologique,' still separates them as distinct species. I have therefore thought it right to state that for me also it is an established fact that the genus *Gnathocentrum* and *Z. canescens* are respectively only the young stages of the genus *Zanclus* and of *Z. cornutus*.

Other authors have already pointed out that it is an error to deny palatine teeth to the genus *Psettus*. The four species

which constitute it are all armed with five very considerable groups of card-like teeth on the vomer, the palatines, and the pterygoids. These four species are:—the true *P. rhombeus* of Forskål from the Red Sea and the Mauritius (figured in the illustrated edition of Cuvier's 'Règne Animal,' pl. xlii. fig. 2), which authors, except the late Sir John Richardson, have erroneously confounded with *P. argenteus*, Linn., from the East Indies, Australia, and China (see 'Voyage of the Erebus and Terror,' pl. xxxv. fig. 1); *P. falciformis*, Lac., from the East Indies, and *P. sebæ*, C. & V., from the west coast of Africa.

The species of the genus *Platax* are subject during their growth and development to such considerable changes, both in physiognomy and in the form of the body and the coloration, that great confusion and the establishment of a number of nominal species could not but result from them. Nevertheless more light has by degrees been thrown upon this question; and in this respect I may refer especially to M. Bleeker's text and the very instructive plates of his great 'Atlas Ichthyologique.' But (and this is a singular fact) he has neglected a character of which M. Klunzinger first indicated the importance, and without which we shall never arrive at a certain determination of the species. In some species (*P. teira*, Forsk.) the three points of the teeth of the outer row are of the same size; in others (*P. vespertilio*, Bl., = *orbicularis*) the middle point is very distinctly larger; in others, again (*P. batavianus* and *P. pinnatus* (L.), Blk.), it is much larger than the others and completely predominant. It would not appear that we know more than these four species; M. Bleeker's fifth species (*P. melanosoma*) is only known from a very young specimen; and the author (whose recent loss is so much deplored) himself regarded it as doubtful.

15. SCOMBERESOX SAURUS.

Dr. Günther having already indicated, although very briefly, the metamorphoses of this fish in their principal features, I may here confine myself to referring to the figures on p. 567 (of the Danish memoir), which represent the different phases of the evolution of the rostrum, as also the physiognomy of the entire fish in one of its youngest stages; and as they are accompanied by a corresponding series of figures representing the very well-known evolution of the same parts in the common Garfish (*Belone vulgaris*), the analogies and differences between the development and transformation of these two nearly allied fishes will strike the eye at once without need of further explanation. I will only add that *Scomberesox saurus*.

is in the highest degree a pelagic fish, the young of which, easily recognized and impossible to confound with any others, are captured everywhere between the tropics, and even beyond them, especially the youngest forms. It is therefore not difficult to obtain a series of all the successive stages of this genus. Nevertheless, in this great accumulation of more or less juvenile forms derived from very widely separated parts of the great seas of the globe, I have been unable to distinguish more than one species, and have come to the conclusion that, properly speaking, we only know a single species belonging to this genus, namely the pelagic and essentially cosmopolitan species known under the name of *S. saurus* or *S. Camperii*. I must, however, make an exception in favour of *S. brevirostris* of California, a very distinct species described by M. Peters, which is distinguished by an excessive abridgement of the two jaws, a peculiarity to which we find an analogue in the young of *S. saurus* in a certain stage of evolution. A critical examination of the characters indicated for the other species of *Scomberesox* also seems to show that they do not rest upon a very solid basis; but I must leave it to the ichthyologists of the shores of the Mediterranean to elucidate from this point of view the case of *S. Rondeletii* and its relationship to *S. saurus* of the Atlantic. The anatomical character upon which its separation as a distinct species is founded has not, so far as I know, been verified since it was established by M. Valenciennes; hence it does not appear to have any real foundation; and the *Scomberesoces* from the Mediterranean that I have examined possessed a swim-bladder like those of the ocean.

Another eminently pelagic form of this group is *Euleptorhamphus longirostris*. There is therefore a certain probability in favour of the opinion that all the different species which have been established in this genus from individuals fished in the two great oceans at points very distant from one another are only representatives of a single pelagic and cosmopolitan species; but for the more satisfactory verification of this supposition it would be necessary to have at command more considerable materials than any museum at present possesses.

16. POMACANTHUS; HOLACANTHUS; CHÆTODON; THOLICHTHYS; EPHIPPUS.

On the shores of the Antilles there live two species of *Pomacanthus* which are certainly distinguished at all ages by positive and non-equivocal characters, but which in habit,

coloration, pattern, squamification, &c. undergo changes so profound and so analogous that we cannot be surprised if ichthyologists on the one hand have created a great number of nominal species, and on the other have not succeeded in separating from each other the very analogous young forms belonging to the two species. The natural consequence of this has been that the connexion between the young and older forms being incapable of being overlooked by those who had sufficient material at their command, authors have fallen into the extreme opposite mistake, and united the two species, including all the phases of their development, under a single species including a whole series of varieties. The considerable materials contained in our two zoological museums now combined (the Royal Museum and that of the University) have enabled me to study the distinctive characters of *P. paru*, Bl., and *P. aureus*, Bl., at all ages, and to confirm, with some modifications, the correctness of the views put forward on this question by MM. Bleeker and Poey.

Holacanthus ciliaris is subject to analogous changes; and *H. formosus* of Castelnau is evidently only a young form of this species. On the contrary, the changes due to age are comparatively insignificant in *H. tricolor*; the young individual represented in pl. v. fig. 6 (of the Danish memoir) has the same large ocellated spot which distinguishes many young Chætodonts. As to the secondary squamification, *Holacanthus ciliaris* stands in the same relation to *H. tricolor* as *Pomacanthus aureus* to *P. paru*. Neither of these genera, so far as we know, passes through the so-called "*Tholichthys*" phase; and it is hardly probable that this case occurs in them.

On the other hand, this phase occurs in so great a number of true Chætodonts, that there can be no doubt it is common to them all. Among the larvæ of Chætodonts or "*Tholichthyes*" that I have had before me I will mention two. One of them (pl. v. fig. 8 of the Danish memoir) represents, in my opinion, one of the stages of *C. sedentarius*, Poey (*gracilis*, Gth.), or of some little-known nearly allied species: the other (fig. 10) I have referred to *Parachætodon ocellatus* (C. & V.); and it would then represent that species in a still younger stage than those at present known, distinguished, among other things, by this peculiarity, that the supraorbital margin terminates in a spine directed obliquely sideways and backwards. Like the Chætodonts, the species of the genera *Ephippus* (*Scatophagus*), *Harpochirus*, and *Chelmo*, after having completely passed through the "*Tholichthys*" phase, so far as such a phase exists, undergo modifications, in the form of the body, the coloration, &c., which merit attention, because they

are always sufficiently great to give rise to the establishment of false species when one has not sufficient materials at command. *Ephippus argus* appears to me, however, to include three species:—the Chinese form, with a small number (20–30) of large spots; the East-Indian type species, with many spots of moderate size; and a form from the Sunda Islands with numerous small spots, a pattern which, in young individuals, changes into transverse bands (*E. ornatus*). Strictly speaking we cannot characterize our youngest *Ephippus* as a “*Tholichthys*”; but nevertheless it has so many points in common with this phase of *Chaetodon* that we may describe it as being in a “*Tholichthyoid*” phase. It somewhat resembles a *Chromis* or a *Pomacentrum*: the body is short, squat, and much compressed, the profile of the head nearly vertical, the skin rough and without scales; the fins are naked; the pattern consists of dark transverse bands; the forehead is broad, convex, and protected by two thick, rounded, triangular shields, which meet in the median line, but which, posteriorly, embrace between them the apex of a parietal boss; there is also on each side a temporal boss accompanied by a stout spine, which is the inferior extremity of a triangular suprascapular tubercle; the prolongation of the operculum (*i. e.* of the præoperculum and interoperculum) is divided by a notch into two short rounded parts, of which the superior is directed backwards, and the inferior inwards and downwards.

17. ACANTHURUS, NASEUS; ACRONURUS, KERIS.

We now know that *Keris* and *Acronurus* are respectively only the young forms of *Naseus* and *Acanthurus*. With regard to the development of the *Kerides* and their transformation into *Naseus* I may refer to the illustrations which accompany the magnificent work that Dr. Günther is publishing under the title of ‘Fische der Südsee.’ There are numerous analogies between the young individuals of the two genera—the form of the body, which is short, with strongly arched contours, the streaking and partial metallic lustre of the skin, the greater length of the anterior dorsal and anal spines, the different position of the ventrals relatively to the pectorals, &c. My own contributions to the history of the metamorphoses of the genus *Acanthurus* consist in the indication of the so-called “*Acronurus*” form of the two West-Indian species, *Acanthurus chirurgus* (*phlebotomus*) and *A. cæruleus*, and of the still more curious form under which the so-called “*Acronurus*” shows itself in its first phase. In fact I regard as a young example of *A. cæruleus*, Schn., the very marked form of *Acronurus* represented in pl. v. fig. 4 (of the

Danish memoir), which was captured in the western part of the Atlantic in the neighbourhood of Brazil; it is 34–37 millims. long, discoid, nearly orbicular, colourless, with a silvery band, &c. The most serious objection that could be raised to this interpretation is the presence of a very different young form (pl. v. fig. 3), not larger, and sometimes even smaller, which, however, notwithstanding its small size, is already in a comparatively more advanced stage, transitional between *Acronurus* and *Acanthurus*, and which must with absolute certainty be referred to *A. cæruleus*. Whether this apparent contradiction arises from the circumstance that we have to do here with different though nearly allied species, or is due to the fact that the metamorphosis may take place a little earlier or a little later, is a question which I shall leave undecided for the present. Another, younger specimen of the same form, perhaps of the same species, but captured N.N.E. of the Bermudas, and characterized especially by the comparatively enormous development of the anterior (strictly the second) spine of the dorsal and anal, which gives these little nearly rhomboidal fishes a very peculiar aspect, makes known to us the "*Acronurus*" phase at a period still less advanced, and which cannot be very far distant from the time of exclusion from the egg.

As a contribution to the evolution of the *Acanthuri* I must also cite the change which the dental apparatus undergoes in *A. strigosus* (*ctenodon*). The adult fish presents this peculiarity—the teeth are pectinated only on one side; the young individuals still in the "*Acronurus*" phase have them pectinated on both sides. As these little fishes pass from the stage of *Acronurus* to that of *Acanthurus* the teeth with unilateral pectination make their appearance and predominate over those with double pectination.

18. *FISTULARIA VILLOSA*; *CENTRISCUS VELITARIS* and *BREVISPINIS*; *CENTRISCOPS* and *ORTHICHTHYS*.

Fistularia villosa of Klunzinger is only a young form of *F. serrata*, Cuvier. The small close-set spines which clothe its skin occur also in young examples of *F. tabacaria*. It is not easy to differentiate these two species (of the east and west) in consequence of the modifications which their proportions undergo during growth &c.; but it is still more difficult to distinguish the two forms of *Aulostomus*, the specific value of which seems to me very doubtful.

Centriscus gracilis, Lowe, of which our Museum possesses several young examples from the Atlantic, south and north of the equator, must almost be regarded as a pelagic species.

The young individuals differ considerably from the adults by the shorter form of the body, their shorter tubiform muzzle, and by the well-marked development of the teeth, of the scutes of the skin, and of the hooked spines of the scales. There is no doubt that "*C. velitaris*," Pallas, is a nearly adult form, and *C. brevispinis*, Kn., Steind., a very young form of *C. gracilis*, and that these two specific names must disappear, as well as the genus *Orthichthys* of Mr. Gill. His genus *Centriscope* (type *C. humerosus*, Rich.) is better founded as regards the physiognomy, but is not based upon any important character or any special peculiarity of organization.

Finally, in a postscript, I refer to the considerable changes which occur in some groups of marine fishes which I have not had the opportunity of examining in this memoir, but which have been elucidated by other authors, or will be so, I hope, hereafter by myself. I may cite, for example, the metamorphoses (1) of the Pleuronectidæ, which have especially been elucidated by MM. Jap. Steenstrup and Alex. Agassiz; (2) of certain Gadoids; the *Couchie*, notwithstanding what may have been said, are the young of various species of *Motella*, and *Hypsiptera argentea* the young form of a Phycid; (3) of the *Macruri*, *Ophidia*, and *Trachypteri*, which have been elucidated by Mr. Emery; (4) of the Sunfish (*Mola rotunda* and *Ranzania truncata*), of which I hope soon to be able to give an explanation conjointly with M. Steenstrup; and, lastly, (5) of *Ansonia Cuvieri*, Risso (*Luvarus imperialis*), of which M. Giglioli has demonstrated that *Diana semilunata*, Risso (*Astrodermus coryphænoides*), is the young form. This last is certainly one of the most remarkable of the transformations presented by the family of the Scomberoids, otherwise so rich in examples of this kind, to the knowledge of which I have also made some contributions in this memoir.

XI.—*Notices of British Fungi*. By the Rev. M. J. BERKELEY, F.R.S., and C. E. BROOME, Esq., F.L.S.

[Continued from ser. 5, vol. iii. p. 212.]

[Plate III.]

1833. *Agaricus* (*Amanita*) *nitidus*, Fr.

Mattishall, Rev. J. M. Duport.

Several specimens have been forwarded, some exactly agree-